Carl L. Newman
Vice President

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May 23, 1975

RE: Indian Point Unit No. 3
Docket No. 50-286

Mr. D. B. Vassallo, Chief
Light Water Reactors Project Branch 1-1
Division of Reactor Licensing
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Vassallo:

Your letter dated May 13, 1975 requested certain clarifications of the Indian Point Unit No. 3 Containment Vessel Structural Integrity Test report. Our response to your inquiry is contained in Enclosure 1 of this letter.

Very truly yours,

Carl L. Newman
Carl L. Newman
Vice President

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ENCLOSURE 1

REQUEST FOR ADDITIONAL INFORMATION

STRUCTURAL INTEGRITY TEST
INDIAN POINT UNIT NO. 3

1. Referring to the Equipment Hatch diameter change in excess of the value permitted by the Acceptance Criteria, discuss the effect of idealization of the opening as round on the validity of the finite element analysis model. Compare the results of the analysis which would be expected if the analytical model did consider the actual shape of the opening with those obtained by the Structural Integrity Test (S.I.T.).

Table IV in Ref. 1 of the Unit No. 3 S.I.T. report shows the measured values of Equipment Hatch Diameter change. I.G.#33 measured 0.030"at 54 psig and I.G. #34 measured .021" at 54 psig. To put the magnitude of these dimensions in perspective they represent a .016% and .011% change in the 16'-0 Equipment Hatch Diameter. The expected Equipment Hatch Diameter change was based on a Finite Element Analysis. The initial ovaling was presented in Section IX Page 35 as an example of where the "as built" condition would differ from the "idealized" condition used in analysis and product differences from the analysis of the extremely small magnitude we are considering.

The ovaling indicated by the Structural Integrity Test is .030"-.021" or a major diameter of .009" greater than the minor diameter. This represents ovaling of approximately .005% when compared to the 16'-0 opening diameter. A finite element analysis is an approximate analysis and is sensitive to many variables such as modeling, properties of concrete and rebar, stiffness etc. The effect of idealization of the opening as round when in fact it is ovaled is insignificant in so far as the validity of the finite element analysis is concerned.

Although initial ovaling of the opening in a finite element idealization could affect the opening diameter changes due to a tendency for the load to make the return to a round configuration it is not expected that the results of the analysis regarding loads which the section must be capable of resisting would be affected if the shape of the opening as obtained by the Structural Integrity Test were modeled. It is in fact possible that if initial ovaling did exist in the structure the S.I.T. results do not represent ovaling but a return to a rounded configuration. In any case the magnitude of the equipment hatch diameter changes is so small that idealization as a round opening for the finite element analysis has no effect on the stiffness of the structure and thus the final analayis results.

2. With regard to the crack of 0.1 inch near the Personnel Lock the following information is requested:

   a. Compare the crack formation and its magnitude in this area obtained from the tests on Units No. 2 and No. 3

Since the quadrant of the personnel lock was not marked for detailed inspection in either the Unit No. 2 or Unit No. 3 test, it is not possible to compare crack magnitude between Unit No. 2 and Unit No. 3 in the area of the worst crack. As discussed in Section IX on Page 36, however, the discontinuity areas at the equipment hatch and personnel lock typically exhibited the largest cracking on both tests. For Unit No. 2, largest cracks in the equipment hatch and personnel lock areas were in the range of .02". For Unit No. 3 in other quadrants of the personnel lock and in the equipment hatch area, maximum cracks on the order of .060" - .080" occurred. In the personnel lock area the crack pattern was similar at each corner of the boss. The lower left quadrant was studied in most detail since it was exhibited the largest magnitude cracks.

2. With regard to the crack of 0.1 inch near the Personnel Lock the following information is requested:

   b. Describe in detail the procedure used to obtain the average crack width over the 20ft. length.

The detailed calculation used to obtain the average crack width over 20'0" will be described below. Refer to the figure on the 13th page of Appendix B in Ref. 1 (Tab XV) for the discussion below.

(1) Average crack width calculation in the vertical direction starting at the lower left corner.

.100"x 3'-0	= .300
.100" + .006/2 x 5'-0 (assume that behind 5'-0 wall where measurements are inaccessible, the crack varies from .100" to .006")	= .265
.040" x 1'-6"	= .060
.006" x 6'-6" (length obtained by subtracting 3'-0 + 5'-0 + 1'6" from total base height of 16'-0)	= .039
.008" x 4'-0	= <u>.032</u>
	.696

.696/20'-0 = .035"

(2) Average crack width calculation in the horizontal direction starting 3'-0 above lower left corner to include largest crack.

.100" x 3'-0	= .300

.050 x 2'-0 (comparing statement on crack taper on page 13 with detailed measurements of page 14 the horizontal cracks did not change between 54 psig and 41 psig so use results on page 14 for this and all following dimensions). = .100

.045 x 1'-0	= .045
.035 x 2'-0	= .070
.030 x 1'-0	= .030
.025 x 1'-0	= .025
.020 x 1'-0	= .020
.015 x 1'-0	= .015
.003 x 3'-0	= .009
.010 x 1'-0	= .010
.015 x 2'-0	= .030
.025 x 1'-0	= .025
.035 x 1'-0	= .035
	.714

$$\frac{.714}{20} = .036$$

It should be noted that the horizontal crack occurred at a horizontal construction joint.

2. With regard to the crack of 0.1 inch near the Personnel Lock the following information is requested:

   c. Your explanation of the magnitude of the subject crack requires further clarification. Discuss the difference in location of rebars in containment for Units No. 2 and No. 3 and its effect on the crack width in a comparative form. Provide a more rational explanation of the differences than that given under item e) of Section IX and demonstrate that the excessive cracking will not impair the structural integrity of the containment.

The difference in rebar placement between Unit #2 and Unit #3 can be seen in the attached Fig. 2.1. For Unit #3 the outermost rebar is the seismic rebar. As shown in Figure 8 under Tab IX a large void is created when the seismic rebar bends around the opening. Figure 8 is the design drawing. It can be seen that a slight shift in seismic rebar location could cause a large void in seiemic rebar at the lower left corner where the largest cracks occurred (see Figure 2.1). The first layer of rebar crossing the crack is thus the diagonal rebar in the orthogonal direction to the layer with the void in the crack area as shown in Figure 2.1 for Unit #3. Due to the 30" spacing of the rebar only one bar can potentially cross the crack area. In addition the horizontal rebars, which are most effective for vertical crack control are 8½" from the surface for Unit #3 since they are pushed further into the section by outside seismic rebar. For Unit #2, where the outside layer of rebar is the horizontal rebar which crosses the potential crack, the concrete cover is 3½". The differences in concrete cover between

Units #2 and #3 in Figure 2.1 comparatively illustrate the differences in rebar placement between Units #2 and #3 and provide an explanation why greater concrete cracking could be expected for Unit #3.

As stated in Item c) of Section IX the primary loads are carried by the rebar in this area; therefore the existence of concrete cracking is not a problem by itself. The concrete cracking is monitored during the test as an indicator of where rebar stresses may be high. Based on the many reasons why cracking is expected in this area as detailed in Section IX and the observation in Item f) of Section IX that the crack closed properly as pressure was reduced, the concrete cracking in this case does not indicate the presence of unacceptable rebar stresses.

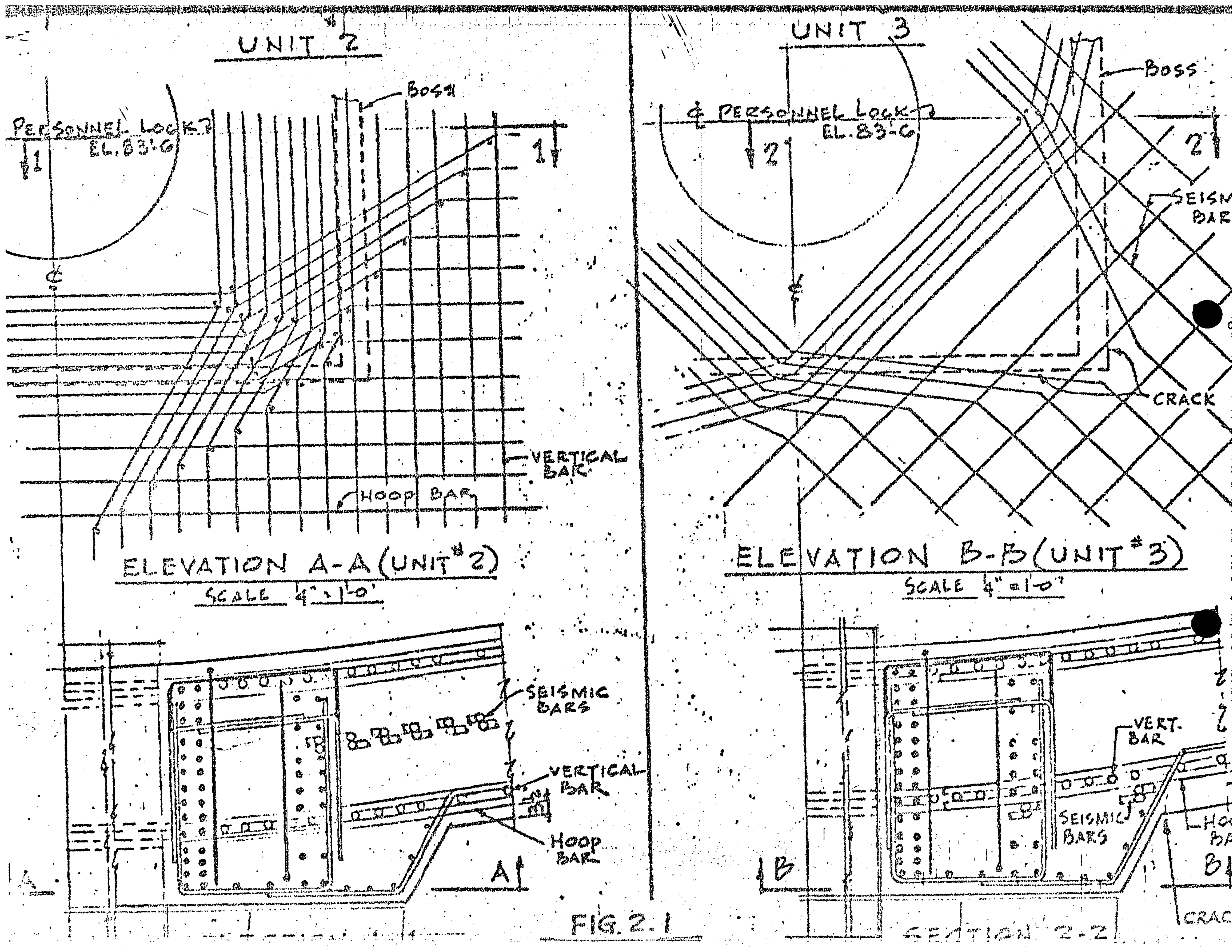

FIG. 2.1

Page 4 of Attachment #2 to HFC-342/LEE-1728